

LF EKSAMEN

FP0001 - BRUKERKURS

V 2016

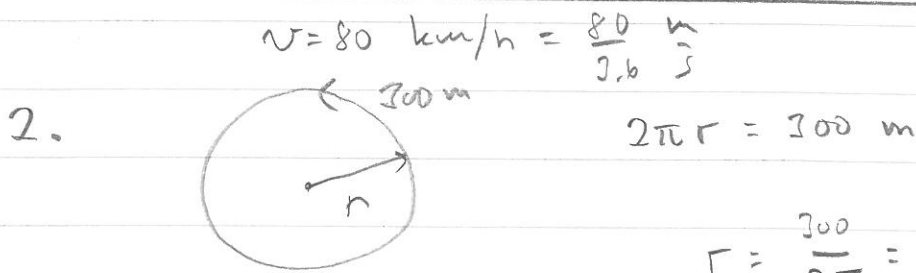
LF ①

LF EKSAMEN FY0001 V2016 (31/5-2016)

DEL A:

1. VED $t = 2,5 \text{ s}$ $\frac{dx}{dt} = 0$; $\frac{d^2x}{dt^2} < 0$

Ⓐ



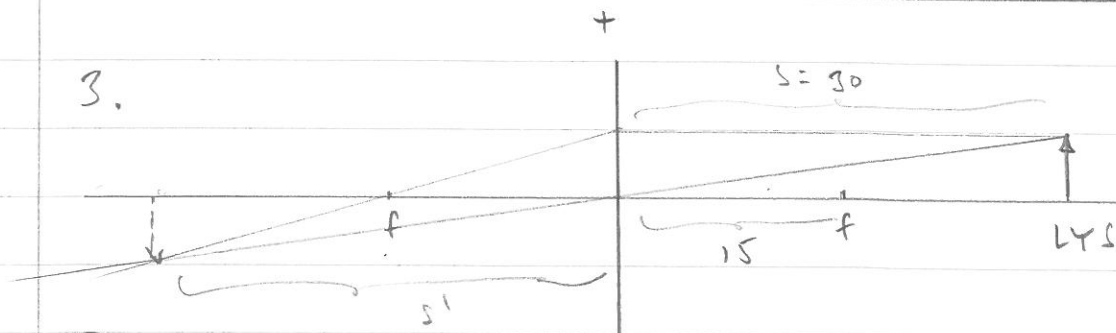
$r = \frac{300}{2\pi} = 47.7 \text{ m}$

FOR SENTRIPEITAL AKS. $a_c = \frac{v^2}{r} = \left(\frac{80}{3.6}\right)^2 \frac{1}{47.7} \approx 40.4$

Ⓓ

N.B. BEVEGELSE KUN I HORIZONTAL PLANET
 \Rightarrow IKKÆ AKS. FRA g

3.



Ⓑ

INVERTERT, UFORSTØRRA

LINJEDYKKE

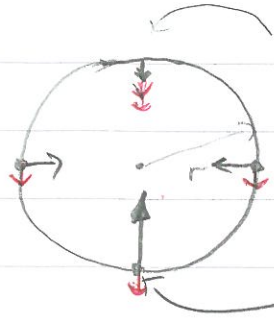
$\frac{1}{30} + \frac{1}{s'} = \frac{1}{15} \Rightarrow \frac{1}{s'} = \frac{1}{15} - \frac{1}{30} = \frac{1}{30} \Rightarrow s' = 30$

$M = -\frac{s'}{s} = -\frac{30}{30} = -1$ om

LF(2)

4.

$a_c = r\omega^2$



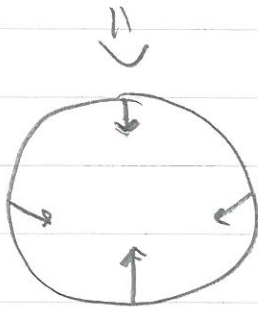
LAV v, LITEN $a_c \sim 0$

MIDDELS v, MIDDELS a_c

HØY v, STOR a_c

ADDERE BIDRAG FRA g

(C)



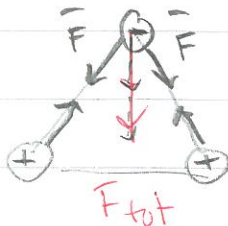
5. HER ER DET LURT Å BRUKE
ENERGI PRINSIPPET

$mgh \rightarrow (4m) \frac{v^2}{2} \Rightarrow v^2 = \frac{gh}{2}$

(B)

$v = \sqrt{\frac{gh}{2}}$

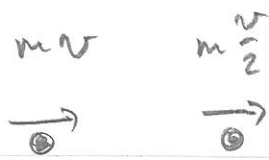
6.



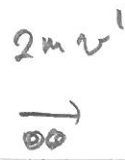
KOMPONENTENE I
X-LEDD KANSELERER

(C)

LF 3
7:



før



etter

REKNIKK
REVENJESKEMME

$$\Rightarrow mv + m\frac{v}{2} = 2mv' \Rightarrow v' = \frac{3v}{4}$$

$E_{kin, \text{ før}}$ $E_f = 4 \cdot \frac{1}{2} \cdot v^2 + \frac{1}{2} \cdot \left(\frac{v}{2}\right)^2 = \frac{5mv^2}{8} = \frac{10mv^2}{16}$

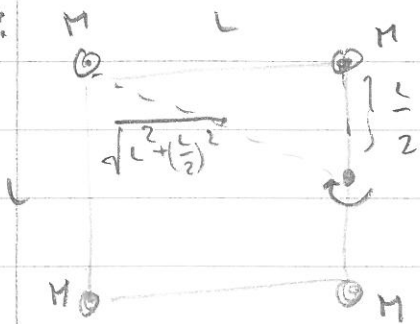
(A)

$E_{kin, \text{ etter}}$ $E_c = \frac{2m}{2} \cdot v'^2 = m \cdot \left(\frac{3v}{4}\right)^2 = \frac{9mv^2}{16}$

↑

$E_{\text{tap}} = \frac{10mv^2}{16} - \frac{9mv^2}{16} = \frac{mv^2}{16}$ $\frac{E_{\text{tap}}}{E_f} = \frac{\frac{mv^2}{16}}{\frac{10mv^2}{16}} = \frac{1}{10} = 10\%$

8:



GENOMENT HVOR PUNKTHASTE GIK

$$I = M \cdot R^2$$

$$I_{\text{tot}} = 2 \times \left[I(R = \frac{L}{2}) \right] + 2 \times \left[I(R = \sqrt{L^2 + (\frac{L}{2})^2}) \right] =$$

$$= 2M \cdot \left(\frac{L}{2}\right)^2 + 2M \left(L^2 + \left(\frac{L}{2}\right)^2 \right) = 2ML^2 + 4M \left(\frac{L}{2}\right)^2 =$$

$= 3ML^2$ (C)

9:



$m = 15 \text{ kg}$
 $M = 1000 \text{ kg}$

$$v = R \cdot \omega \Rightarrow \omega = \frac{v}{R}$$

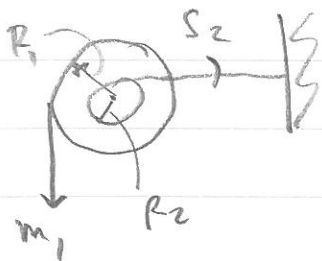
$$I = \frac{1}{2} m R^2 \text{ HVORT TIDUL}$$

$$K_{\text{rot}} = \frac{1}{2} I \cdot \omega^2 = \frac{1}{2} \cdot \frac{1}{2} m R^2 \cdot \omega^2 = \frac{1}{4} m v^2$$

$$\frac{K_{\text{rot}}}{K_{\text{trans}}} = \frac{4 \times \frac{1}{4} m v^2}{\frac{1}{2} m v^2} = \frac{2m}{m} = \frac{2 \cdot 15}{1000} = \frac{30}{1000} = \frac{3}{100}$$

(C)

10:



LIKEVERT FOR DECELERERT F. r

$$m_1 \cdot g \cdot R_1 = S_2 \cdot R_2 \Rightarrow S_2 = m_1 \cdot g \cdot \frac{R_1}{R_2}$$

(A)

4F (4)

Besvarelsesark del A: No# LF

1: A -

2: D -

3: B -

4: C

5: B

6: C -

7: A

8: C

9: C

10: A

LF (5)

11. $v = 72 \frac{\text{km}}{\text{h}} = \frac{72}{3.6} \frac{\text{m}}{\text{s}} = 20 \frac{\text{m}}{\text{s}}$

$\lambda = 0.17 \text{ m}$

$v_{\text{luft}} = 340 \frac{\text{m}}{\text{s}}$ $v = \lambda \cdot f \Rightarrow f = \frac{v}{\lambda} = \frac{340}{0.17} = 2000 \text{ Hz}$

a) Kjøreren MOT ; f ØKER

BRUK $f' = f \left(\frac{1}{1 - \frac{v_e}{v}} \right) = 2000 \cdot \left(\frac{1}{1 - \frac{20}{340}} \right) \approx 2125 \text{ Hz}$

b) Kjøreren FRA ; f MINKER

BRUK $f' = f \left(\frac{1}{1 + \frac{v_e}{v}} \right) = 1889 \text{ Hz}$

TREKK

FEIL LIANING - 10

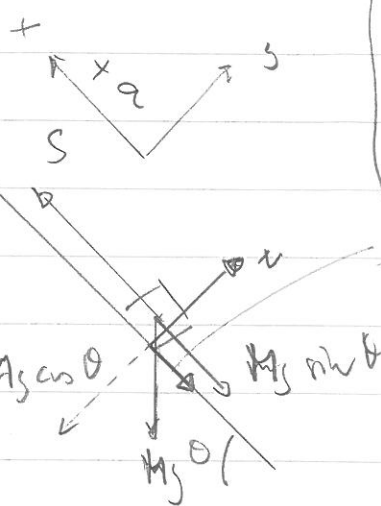
FEIL HØY MOT / LAV FRA - 10

FEIL f - 10

12)

HVIS IKKE
FRIKSJON
VIL SKI
I + x, som

+a



$m = 75 \text{ kg}$
 $M = 82 \text{ kg}$
 $\theta = 45^\circ, \mu = 0.1$
 F_f

$m_g > M_g \sin \theta$.
Frikisjon kan
kan brems, ikke trekke

NEWTON 1 & 2

S og
a
ukjente

BØTTA : $\sum \vec{F} = m \cdot a \Rightarrow m_g - S = m \cdot a \quad (1)$

MANN, x: $\sum \vec{F} = M \cdot a \Rightarrow S - F_f - M_g \sin \theta = M \cdot a \quad (2)$

MANN, y: $N - M_g \cos \theta = 0 \Rightarrow N = M_g \cos \theta \quad (3)$

FRIKSJONS VILKOR $F_f = \mu \cdot N = \mu M_g \cos \theta \quad (4)$

(4) \rightarrow (2) $S - \mu M_g \cos \theta - M_g \sin \theta = M \cdot a \quad (5)$

(1) Gir $S = m(g - a) \rightarrow (3)$

$\Rightarrow m(g - a) - \mu M_g \cos \theta - M_g \sin \theta = M \cdot a$

$m g - \mu M_g \cos \theta - M_g \sin \theta = (M + m) a$

$\Rightarrow a = \frac{g}{(M + m)} \cdot [m - \mu M \cos \theta - M \sin \theta]$



(LFT)

12 FORT

11.22

TAU $a = \frac{9.8}{157} \left[75 - \underbrace{0.1 \cdot 82 \cdot \frac{1}{\sqrt{2}}}_{5.798} - \underbrace{\frac{82}{\sqrt{2}}}_{57.98} \right]$

$\approx 0.70 \frac{m}{s^2}$

a) $S = m(g-a) = 75(9.8-0.7) = 682.5 N$

KONTROL:

(S) air $S = M \cdot a + \mu M g \cos \theta + M g \sin \theta = 682.5 N$
OK

57.4 56.82 568.2

b) BREUK $x = \frac{v^2 - v_0^2}{2a} \Rightarrow v = \sqrt{2ax}$

$= \sqrt{2 \cdot 0.7 \cdot 7} = 3.1 \frac{m}{s}$

SENSOR

+10 (max) FOR GOD FIGUR MED ALLE KREFTER RETT

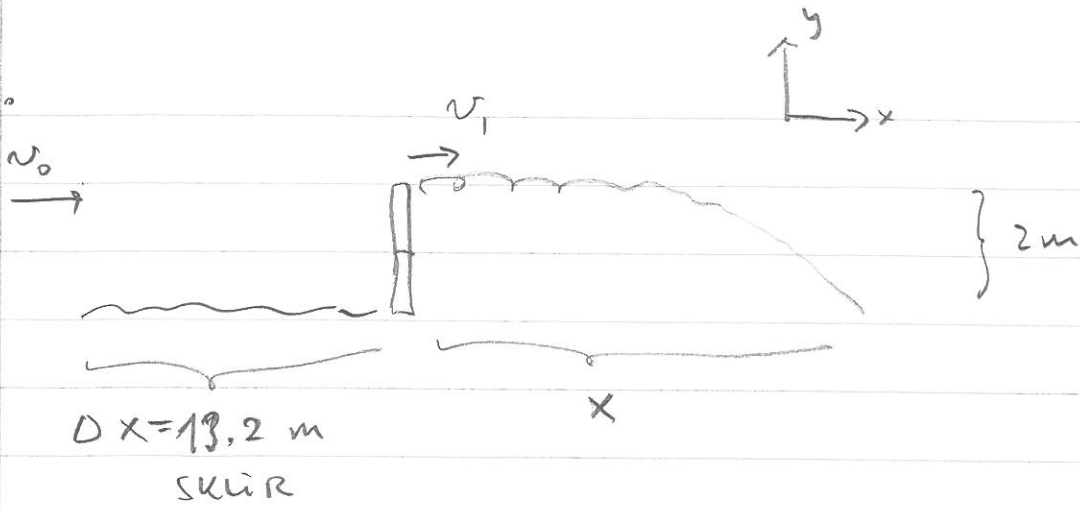
+5 BEREGNET S HELT RIKTIG

+5 " " " HELT RIKTIG

trekil for små avvik

(LFS)

13.



Gitt $v_1 = 60 \text{ km/h} \approx 16.67 \frac{\text{m}}{\text{s}}$; $\mu = 0.6$; $g = 9.8$
 $\Delta x = 13.2 \text{ m}$

a) TIDEN DET TAR ER DENNITTE SAM Å
 FALLE 2 m ↓

$$x = x_0 + v_x t + \frac{1}{2} a_x t^2 \quad \xrightarrow{\substack{\text{filpane} \\ \text{y-koordinat}}} \quad y = y_0 + v_y t - \frac{1}{2} g t^2$$

$= 0$

$y_0 = 2 \Rightarrow y = 0$ (bakken)

$\Rightarrow 0 = 2 - \frac{1}{2} g t^2 \Rightarrow \frac{4}{g} = t^2 \Rightarrow t = \frac{2}{\sqrt{g}} \approx 0.639 \text{ s}$

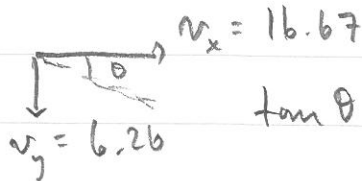
FINN NÅ x $x = v_x t = 16.67 \frac{\text{m}}{\text{s}} \cdot 0.639 \text{ s} \approx 10.65 \text{ m}$

ans. 11 m

b) NÅR MAN FALT 2 m ER HASTIGHETEN

$v_y = v_{oy} + a \cdot t \Rightarrow v_y = 0 - g \cdot t = -9.8 \cdot 0.639 \approx -6.26 \frac{\text{m}}{\text{s}}$

∴ VED NEDSLAGSPUNKTET



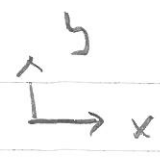
$\tan \theta = \frac{v_y}{v_x} \Rightarrow \theta = 20.6^\circ$

ans. 21°

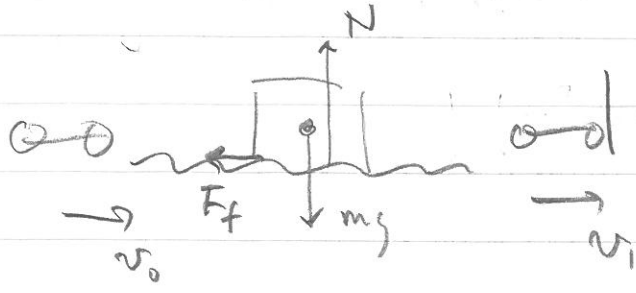
0.375657

(LF9)

13. FRICTION



c)



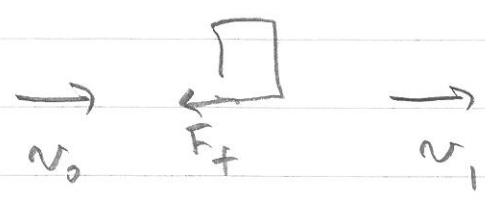
NEWTON x: $-F_f = m \cdot a_x$

F_f gilt AN FRIKTION $F_f = \mu \cdot N$

NEWTON y: $-m \cdot g + N = 0 \Rightarrow N = m \cdot g$

$\Rightarrow F_f = -\mu m g \Rightarrow -\mu m g = m \cdot a_x \Rightarrow a = -\mu g$
QED

d) ENERGIEBILANZIERUNG (ALLES GUT WIE GIBT) (BONUS FÜR ENERGIE-BILANZ)



$W_f = \text{FRIKTION ARBEIT} = -F_f \cdot x = -\mu m g x$

$K_0 = \frac{1}{2} m v_0^2$
 $K_1 = \frac{1}{2} m v_1^2$

$K_1 - K_0 = W_f \Rightarrow \frac{1}{2} m (v_1^2 - v_0^2) = -\mu m g x$

$\Rightarrow x = \frac{v_0^2 - v_1^2}{2 \mu g}$; $v_0 = \sqrt{\frac{1}{2} v_1^2 + 2 \mu g x} \approx 20.8 \frac{m}{s}$
Ans. $\sim 75 \text{ km/h}$